

TWO-PIECE BRUSHROLL

Background of the Invention

The present invention relates in general to suction cleaners. More particularly, the invention relates to an improved rotary brushroll assembly for mounting in a suction inlet of a suction cleaner, such as a vacuum cleaner, and will be described with particular reference thereto. However, it is to be appreciated that the present invention may also be amenable for other applications.

The use of rotary brushrolls in cleaning apparatus such as vacuum cleaners is well known. Prior art vacuum cleaner brushrolls generally include an elongated cylindrical roll body rotatably supported in various constructions at either end by bearings connected to adjacent sides of a vacuum cleaner suction opening. The roll body is rotated by a belt operably connected to a vacuum cleaner motor. The motor driven belt rotates the brushroll to dislodge dirt and debris on a surface to be cleaned allowing permanent removal of the dislodged dirt and debris by appropriate air suction into the suction opening.

More specifically, the brushroll body carries on its outer surface an array of tufted bristles or tufts extending radially outward from the outer surface. The tuft array is distributed regularly about the periphery of the roll body to balance the moments of inertia about the roll body axis. As the roll body rotates, the tufts contact the surface, such as a carpet, and loosen dirt or debris from carpet fibers. The tufts are generally mounted in a helical pattern to better facilitate this removal of

debris from the carpet fibers as the vacuum cleaner moves over the carpet surface. Suction within the suction opening then moves the loosened dirt and debris to a filter/storage area of the vacuum cleaner.

5 Previously, wooden dowels were used for brushrolls. Now, many manufactures have switched to plastic. The prior art plastic brushroll bodies are each often fabricated as a single, unitary piece from a relatively expensive plastic material using conventional
10 manufacturing techniques, such as injection molding, for durability. If an inexpensive type of plastic were used, the brushrolls would function properly initially but after extended use the portion of the brushroll body that is contacted by the motor driven belt would degrade.
15 Eventually this degradation can cause the engagement between the belt and the brushroll to fail thereby disabling the rotation function of the brushroll.

Thus, there remains a need for a brushroll that remains reliable over an extended use period while
20 continuing to be relatively simple and inexpensive to fabricate, assemble, and operate. The present invention provides a new and improved brushroll for use in a vacuum cleaner for overcoming the above-referenced drawbacks and others.

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Summary of the Invention

In accordance with the present invention, a new and improved roll assembly for use in a vacuum cleaner is provided.

30 More particularly in accordance with this aspect of the invention, the roll assembly comprises a housing, an elongated roll body and an agitator extending radially away

from the roll body, and a pulley section mounted to one end of the elongated roll body wherein the roll body and the pulley section are rotatably mounted to the housing.

According to another aspect of the present invention, a new and improved roller assembly for use in a suction cleaner is provided.

More particularly in accordance with this aspect of the invention, the roller assembly comprises a housing having a suction opening and a roller mounted adjacent the suction opening. The roller comprises an elongated roller body comprising a first material and a pulley section comprising a second material. The pulley section is axially connected to the elongated roller body.

According to still another aspect of the present invention, a new and improved brushroll for a vacuum cleaner is provided.

More particularly in accordance with this aspect of the invention, the brushroll comprises a roll body including a first end, a second end and a rotational axis. A first bore extends from the first end to the second end of the roll body along the rotational axis. The roll body further includes a first connecting element located at the roll body second end. The brushroll further comprises a pulley section including a first end, a second end and a pulley rotational axis. A second centrally positioned bore extends from the pulley first end to the pulley second end of the pulley section along the pulley rotational axis. The pulley further includes a second connecting element located at the pulley first end for engaging the first connecting element. A shaft extends through the first and second bores. At least one bearing is mounted on the shaft and rotatably positions the roll body and the pulley on the shaft.

Brief Description of the Drawings

The invention may take physical form in certain parts and arrangements of parts, a preferred embodiment of which will be described in detail in this specification and
5 illustrated in the accompanying drawings which form a part hereof and wherein:

FIG. 1 is a bottom plan view of a vacuum cleaner showing a brushroll assembly mounted in a suction opening of the vacuum cleaner in accordance with the present
10 invention;

FIG. 2 is an exploded perspective view of a mirror image of the brushroll assembly of Fig. 1 showing a roll body, a pulley, and a pair of mounting assemblies;

FIG. 3 is an enlarged exploded side elevational
15 view of the brushroll assembly of FIG. 2 showing a pulley end thereof;

FIG. 4 is an assembled cross-sectional view of the pulley end of FIG. 3;

FIG. 5 is an enlarged exploded side elevational
20 view of the brushroll assembly of FIG. 2 showing a roll body end thereof; and

FIG. 6 is an enlarged assembled cross-sectional view of a portion of the roll body end of FIG. 5.

Detailed Description of the Preferred Embodiment

Referring now to the drawings wherein the showings are for purposes of illustrating the preferred embodiment of the invention only and not for purposes of limiting the same, FIG. 1 shows the underside of a vacuum
30 cleaner A having a main suction opening B formed therein. The vacuum cleaner A comprises a filter chamber (not shown)

for separating dust and dirt from a suction air stream and a suction source (not shown) in fluid communication with the main suction opening B. A brushroll assembly 10 is operatively mounted for rotation within the suction opening

5 B. A selectively moving motor-driven belt C frictionally engages a portion of the brushroll assembly 10 providing a means for rotating the brushroll assembly 10. While the vacuum cleaner A is of an upright type, it should be appreciated by those of average skill in the art that the present invention described and illustrated herein could

10 also be employed for use on remote nozzle vacuum cleaners such as canister vacuum cleaners, wet/dry vacuums and central vacuums which can employ a rotating brushroll as well as carpet extractors and hand-held vacuum cleaners and

15 in a variety of other brushroll type cleaners.

With reference now to FIG. 2, the brushroll assembly 10 comprises a brushroll 12 including an elongated roll body 14 threadedly connected to a pulley section 16. A shaft 18 extends through both the roll body 14 and the

20 pulley section 16, since they are both hollow. A pair of substantially identical end mounting assemblies 20, 22 accommodate the ends of the shaft 18 and allow the brushroll 12 to be rotatably mounted. Each end assembly 20, 22 is operably connectable with a respective brushroll

25 mounting structure (not shown) in the vacuum cleaner suction opening B (Fig. 1). The generally tubular brushroll 12 receives the shaft 18 therethrough. A first, pulley end 24 of the brushroll 12 connects to the first, pulley end assembly 20. A second, roll body end 26

30 connects to the second, roll body end assembly 22. The shaft 18 connects between the end assemblies 20, 22 and defines a brushroll rotational axis 28 along the brushroll 12 between its first and second ends 24, 26.

More specifically, the roll body 14 includes a first roll body end 30 and, axially opposite, a second roll body end 32 that is the same as the second brushroll end 26. The roll body 14 is formed as an elongated tube-like structure having an outer surface 34 and a coaxially cylindrical inner surface 36. The inner surface 36 runs completely through the length of the roll body 14 defining a throughhole 38 (Fig. 6) therein for receiving the shaft 18. Thus, the throughhole 38 extends from the first roll body end 30 to the second roll body end 32 along the brush roll rotational axis 28. With reference now to Fig. 5, at the second roll body end 32, a raised lip 40 extends radially outward around the circumference of the roll body 14.

With additional reference to Fig. 2, the roll body 14 includes an agitator means which can be a pair of brush tufting arrays 50, 52 extending radially outwardly from the outer surface 34 of the roll body 14 and spiral in a helical manner along the length of the roll body 14. Of course, other types of conventional agitation means, such as beater bars, or the like could also protrude radially from a dowel instead of bristle tufts. In the embodiment illustrated, the brush tufting arrays 50, 52 are positioned one-hundred and eighty degrees apart from each other. The tufting arrays may include gaps 53 extending around the circumference of the roll body 14 to accommodate structural elements extending across the suction opening B (Fig. 1). Further, with specific reference to Fig. 5, each pair of brush tufting arrays 50, 52 may be mounted on a raised portion 54 of the outer surface 34 and has a plurality of tufts 56 extending therefrom. The brush tufts 56 may be attached to the raised portion 54 by any known conventional

means. During rotation of the brushroll 12, the brush tufting arrays 50, 52 are effective to loosen and pick up dirt and debris from a surface, such as carpeting, which is to be cleaned by the vacuum cleaner A.

5 With reference to Fig. 4, a first connecting element 58 is provided adjacent the first roll body end 30. The connecting element 58 can be a counterbore 60 immediately adjacent the first roll body end 30 and a set of internal threads 62 defined along a portion of the inner
10 surface 36 near the first roll body end 30 and immediately adjacent the counterbore 60. With reference to Fig. 6, an angled mating surface 42 is provided for engagement with one of the end assemblies 22 at the second roll body end 32. Adjacent the angled mating surface 42, an axial flange
15 44 is provided.

 With reference to Fig. 3, the pulley section 16 includes a first pulley end 64 that is the same as the brushroll end 20. Axially opposite the first pulley end 64, the pulley section 16 includes a second pulley end 66.
20 Similar to the roll body 14, the pulley section 16 is formed as a tube-like structure and includes a raised lip 67 extending radially outward around the circumference of the pulley section 16. With reference to Fig. 4, the pulley section 16 includes an inner surface 68 and a
25 generally coaxially cylindrical outer surface 70. The inner surface 68 extends along the length of the pulley section 16 defining a throughhole 72 therein. However, unlike the roll body 14, the elongation of the pulley section 16 is abbreviated. Further, with additional
30 reference to Fig. 3, the pulley section 16 includes three unique sections, a tuft section 74, a belt section 76, and a connector section 78.

The tuft section 74 includes a pair of pulley brush tufting arrays 80, 82 extending radially outwardly from the pulley outer surface 70 along the longitudinal length of the tuft section 74 and helically relative to the brushroll rotational axis 28. Like the roll body 14, each of the pulley brush tufting arrays 80, 82 is positioned one-hundred and eighty degrees relative to each other and each of the pair of pulley brush tufting arrays 80, 82 includes a raised portion 84 relative to the outer surface 70 with a plurality of tufts 86 extending therefrom. The tufts 86 are attached to the raised portion 84 in the manner described above in reference to the roll body tufting 56. The tuft section 74 carrying the array of brush tufting 80, 82 is adjacent the first pulley end 64.

15 With reference to Fig. 4, a second angled mating surface 98 is provided for engagement with the other of the end assemblies 20 at the first pulley end 64. Adjacent the angled mating surface 98, an axial flange 99 is provided.

With reference again to Fig. 3, the connector section 78 includes a second connecting element 88 located adjacent the pulley section second end 66 for engaging the first connecting element 58 of the roll body 14. With additional reference to Fig. 4, the second connecting element 88 includes a nose portion 90 for engaging the inner surface 36 of the roll body 14, an externally threaded portion 92 for threaded engagement with the internal threads 62 defined on the roll body inner surface 36, and a raised portion 94 for mating engagement with the counterbore 60 of the roll body 14. When the pulley section 16 and the roll body 14 are threadedly engaged to one another, the first roll body end 30 mates with a radial edge 96 of the pulley section 16 and the respective outer

surfaces 34, 70 of the pulley section 16 and the roll body 14 are circumferentially flush or contiguous with one another near the mated engagement of the radial edge 96 and the first roll body end 30.

5 With specific reference to Fig. 3, the belt engaging section 76 extends along a central portion of the outer surface 70 between the tuft section 74 and the connector section 78 and around the entire circumference of the pulley section 16. As shown in Fig. 4, the belt
10 engaging section 76 is thickened and adapted to be frictionally engaged by the belt C (Fig. 1) of the vacuum cleaner A. As discussed above, the belt C is selectively motor driven and, through the frictional engagement with the belt section 76, rotates the pulley section 16, and
15 hence the entire brushroll 12, when actuated.

When the pulley section 16 and the roll body 14 are connected to one another, the pulley throughhole 72 and the roll body throughhole 38 together form a single, elongated brushroll throughhole extending along the entire
20 length of the brushroll and concentric with the brush roll rotational axis 28. The shaft 18 is received through the brushroll throughhole 38, 72 for operatively supporting the brushroll 12 within the suction opening B of the vacuum cleaner A (Fig. 1). More specifically, the brushroll 12 is
25 connected to the shaft 18 by the end assemblies 20, 22 and together the shaft 18 and the end roll assemblies 20, 22 operatively and rotatably support the brushroll 12 in the suction opening B.

With reference to Fig. 2, the mounting assemblies
30 20, 22 each include an annular bearing 100, a bearing support 102, and an end cap 104. With additional reference to Figs. 4 and 6, each annular bearing 100 is fitted onto

the shaft 18 and positioned near an end thereof. The engagement between the shaft 18 and the annular bearing 100 may be characterized as frictional and nonrotational. Each bearing support 102 connects between the bearing 100 and the brushroll 12. More specifically with reference to Fig. 4, the bearing support 102 is positioned at the first end 24 of the brushroll 12 and connects between the respective bearing 100 and the pulley section 16. With reference to Fig. 6, the bearing support 102 is positioned at the second end 26 of the brushroll 12 and connects between the respective bearing 100 and the roll body 14.

With reference to Figs. 4 and 6, each bearing support 102 includes a nose 106 for engagement with either the inner surface 36 of the roll body 14 at the second brushroll end 26 or the inner surface 68 of the pulley section 16 at the first brushroll end 24. The nose extends in a direction parallel to the brushroll rotational axis 28 (Fig. 2). An angled surface 108 extends radially outwardly from the nose 106 and mates with respective first and second mating surfaces 42, 98 of the roll body 14 and the pulley section 16. A thread-retarding flange 110 extends from the axially distal end of the angled surface 108 and parallel to the nose 106. The thread retarding flange 110 extends axially a dimension sufficient to retard thread and like string material from undesirably becoming wound on the shaft 18.

The end of the shaft 18 and the corresponding thread retarding flange 110 rotatably engage or mount into a respective end cap 104. The end caps 104 are securely received within the ends of the suction opening B (Fig. 1) and serve as holding devices for the shaft 18 and the brushroll 12. The end caps 104 each include a centrally

positioned cup 114 generally concentric with the brushroll rotational axis 28 (Fig. 2). The cups 114 each receive an end of the shaft 18 and prevent radial movement of the shaft 18 relative to the end cap 104. The pair of cups 5 114, one at each end of the shaft 18, together prevent axial movement of the shaft 18 relative to the opposing, pair of end caps 104 and the suction opening B. The end caps 104 also each include an outer annular cup 116 for receiving the thread retarding flange 110 of the respective 10 bearing supports 102. Together, the annular cup 116 and the flange 110 form a labyrinth seal. The outer annular cups 116 are axially shorter relative to the cups 114 but are concentric therewith.

Prior art brushrolls were commonly formed as a 15 single unitary piece of wood. More recently, plastic has become the material of choice. It has been found, however, that the frictional engagement between the vacuum belt C and the pulley portion of a prior art brushroll often caused a significant amount of wear on the pulley portion 20 and premature failure thereof. To prevent such failure, brushrolls could be constructed of a more wear resistant material, such as glass-filled polypropylene, which is known to have increased wear resistance as compared to softer plastics. However, manufacturing an entire 25 brushroll of glass-filled polypropylene can be rather expensive and may be cost prohibitive.

Therefore, the present invention provides a two-piece brushroll 12 wherein the roll body 14 may be constructed of conventional, softer, less expensive plastic 30 materials, such as polypropylene, and only the pulley section 16 may be made of a relatively hard, wear-resistant, more expensive material, such as a glass-filled polypropylene material. Conventional manufacturing

techniques, such as injection molding, may be employed to make the roll body 14 and the pulley section 16.

As discussed above, the pulley section 16 includes the male threaded portion 92 that threadedly engages the female threads 62 of the roll body 14. In this arrangement, the glass-filled polypropylene pulley section 16 which includes a belt engaging section 76 is able to withstand the increased wear caused by engagement with the vacuum belt C. However, the increased material and manufacturing costs associated with the more wear resistant material, in this case a glass-filled polypropylene material, are not added to the entire brushroll 12. Rather, the more expensive material is used only in the region of the brushroll 12 requiring increased wear resistant properties.

It should be appreciated by those of average skill in the art that other materials can be used to manufacture or form the pulley section 16 and the roll body 14. One of the features of this invention is the use of differing materials for the brushroll 12 to increase the wear resistance to belt-wear of the brushroll 12 in the area of the brushroll 12 that is engaged to the belt C. Another feature of this invention is the use of differing materials in a brushroll 12 to limit or lessen both the material and manufacturing costs associated with making the brushroll 12 more wear resistant. Accordingly, other materials could be used to achieve similar results and all such combinations of materials are to be considered within the scope of the present invention.

Yet another feature of this invention is the use of multiple components threadedly connected to one another, in this case the roll body 14 and the pulley section 16.

Although the embodiment herein described includes a pulley section 16 having a male threaded portion 92 and a roll body 14 having female threads 62 for threadedly connecting to the male threaded portion 92, the male and female threaded relationship could be reversed. Preferably, in either arrangement, the threading relationship is such between the roll body 14 and the pulley section 16 that as the brushroll 12 is rotated, the roll body 14 and the pulley section 16 are spun into closer engagement with each other, rather than being spun away from each other.

Furthermore, it should also be appreciated by those of average skill in the art that other means of connecting the pulley section 16 and the roll body 14 can be used. For example, the pulley section 16 and the roll body 14 can be connected by a press fit connection wherein one of the pulley section 16 and the roll body 14 is pressed into the other of the pulley section 16 and the roll body 14. Also, adhesives could be used to connect the components 14, 16, or a fusion process could be used to weld the roll body 14 and the pulley section 16 together. These and other known connecting means are to be considered within the scope of the present invention.

The invention has been described with reference to a preferred embodiment. Obviously, modifications and alterations will occur to others upon reading and understanding the preceding detailed description. It is intended that the invention be construed as including all such modifications and alterations insofar as they are within the scope of the appended claims or the equivalents thereof.